

# The NAC Innovator

National Automotive Center Technical Outreach



Engineers from TARDEC's National Automotive Center (NAC) in cooperation with its commercial and government partners are combining emerging computer technologies with simulation and distributed multi-functional teams to create robust, collaborative life cycle processes for Army materiel. This evolution to making SMART decisions with soldiers requires the adoption of new strategies for integrated concept/product team interaction. Each participant in a system's life cycle is empowered with timely and relevant information. Engineers need access to and direct involvement in requirements generation and operational considerations. Soldiers need access to and direct involvement in system design and performance considerations. System production, training and support concerns must be considered early and often. The U.S. Army TACOM-TARDEC established the Simulation Throughout the Lifecycle (SimTLC) Program to meet these challenges.

Sharing goals with the Department of Defense Simulation Based Acquisition (SBA) and the Department of the Army's Simulation, Modeling, Acquisition, Requirements, and Training (SMART) initiatives, SimTLC is committed to effecting major changes throughout the acquisition process. They strive to significantly increase productivity, cut costs, reduce time, and minimize the risk involved in delivering world class military systems. Making good on this vision of "better, faster, cheaper"



## Making SMART Decisions with Soldiers

calls for nothing less than a radical transformation in how the Army conducts its business as it involves not just the formal acquisition process but also the culture and the surrounding dynamic technical environment.

SimTLC is developing technologies, tools, and processes that support collaborative interaction and widespread simulation use throughout all phases of a system's lifecycle. Engineers at TARDEC-NAC have partnered through the use of dual use science and technology programs

(DUAP) with industry experts in high-end graphics, visualization, modeling, networking, and product design to develop commercial based solutions and tools to meet the acquisition challenges of the 21<sup>st</sup> century. SimTLC is solving **real challenges** for the Army.

Experimentation with integrated concept and product teams, including participants scattered across the country, is fundamental to SimTLC. Testing and evaluating the developing tools throughout the collaborative enterprise is critical. These assessments will provide feedback into future tool development and insight into the evolving collaboration process. SimTLC is interfacing **real soldiers** with the acquisition process.

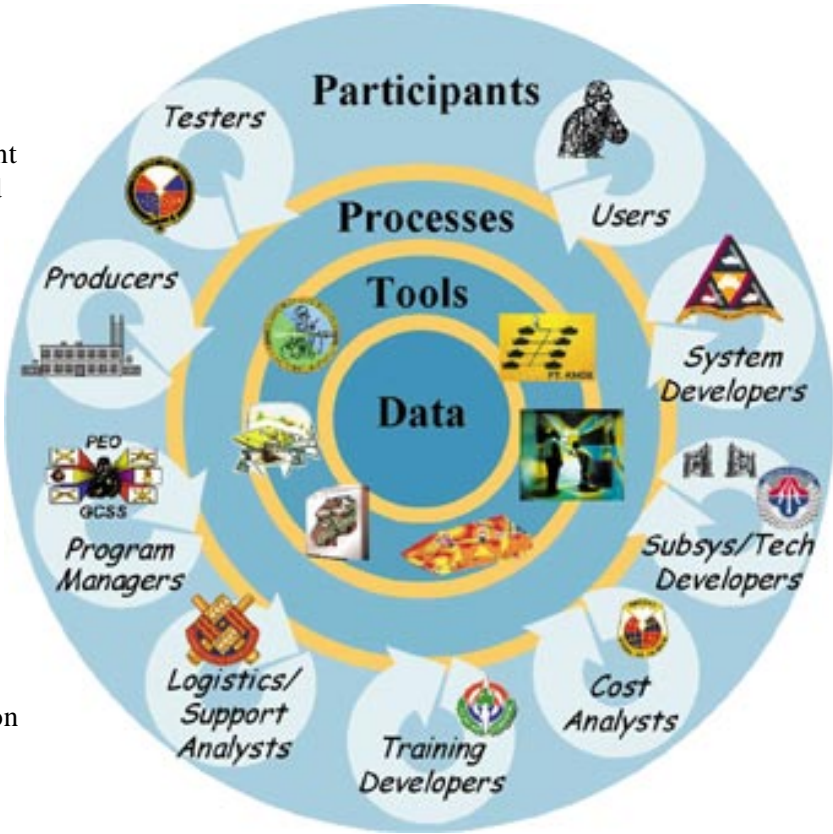
Providing solutions to meet the needs of real Army programs using the collaboration tools and new concurrent processes developed under SimTLC is the ultimate goal. That is why SimTLC is applying these tools and processes to three Army vehicle programs. The selected programs are representative of vehicles at different phases of a system's acquisition lifecycle, ranging from a fielded system, to a Milestone II system, to a Pre-Milestone 0 conceptual system. Each SimTLC Pilot Project will pose different problems that will exercise the capabilities of the developing technologies and the new collaboration processes. By taking this approach, TARDEC-NAC engineers can stringently test how effectively SimTLC collaboration tools and processes are meeting the challenges throughout a system lifecycle. SimTLC is using collaboration tools to develop **real solutions**.

## Laying the Foundation Detailing SimTLC

Simulation Throughout the Lifecycle is developing managed, collaborative processes that fully exploit modeling and simulation throughout all phases of a system's lifecycle. These SimTLC processes have concurrent involvement of all distributed participants, including the user, engineering, acquisition, support, and training communities. SimTLC is leveraging commercial technologies and developing the necessary interfaces and processes that allow the Army to acquire and support future systems and fielded system upgrades better, faster, and at a lower cost. It is defining new system lifecycle processes –

managed, concurrent, collaborative processes.

Today's military-business environment can be characterized as distributed and global where functional expertise is located at multiple locations throughout the world. Similarly, functional data is developed and maintained throughout this distributed structure. New tools and processes are required to facilitate collaboration and the conduct of concurrent activities amongst members of the distributed enterprise. The maturity of web-based information technologies has created opportunities for new ways to connect people and information. Web based data integration and collaboration are fundamental to support distributed people and processes.



(continued on page 4)



# Connecting in the Virtual World

## Networked Immersive Environments



Taking integrated product and concept teams to the ultimate level of collaboration and interaction is key to SimTLC. That is why engineers at TARDEC teamed with EDS Corporation, SGI, and Multigen Paradigm, Inc., are developing a tool-set for system engineers, design engineers, end users, and specialty team members to directly utilize Computer Aided Design (CAD) files to rapidly generate models within a synthetic, collaborative environment. This approach aims to simplify the process of displaying engineering level three-dimensional full-scale size parts, assemblies, and systems for real-time distributed man-in-the-loop interaction and simulation evaluations within a virtual reality environment.

A primary goal of the Virtual Distributed Collaboration Environment (VDCE) Dual Use Application Program (DUAP) is to develop technologies that allow design team members from geographically distributed sites to “collaborate” in the design and analysis process without the concerns usually associated with temporal lags, asynchronous processing, data mismatching, and information scaling. Geographically distributed teams of engineers, researchers, and other users will be able to participate in collaborative design sessions that will result in improvements in the acquisition process as well as the quality of the final system product at reduced costs.

This partnership and collaborative virtual design research will result in:

- multiple CAVE and similar 3-D virtual reality display media networked for the purpose of collaborative design and development
- an integrated data environment for data management and simultaneous sharing of product development data among multiple teams
- the capability to convert commonly used CAD data into a simple virtual reality format
- software to support collaborative immersive and interactive graphical environments
- the development of high-resolution computer graphics as a standard
- the creation of software to add behaviors and attributes to models to make them functionally realistic
- the implementation of a two-handed interface to allow participants in a virtual environment to manipulate the 3-D parts, assemblies, or systems interactively and in real-time

For further information on the VDCE DUAP contact Dr. Grace M. Bochenek at [bocheneg@tacom.army.mil](mailto:bocheneg@tacom.army.mil).

**Project Partners:**  
Electronic Data Systems (EDS), SGI, Multigen Paradigm, and TARDEC

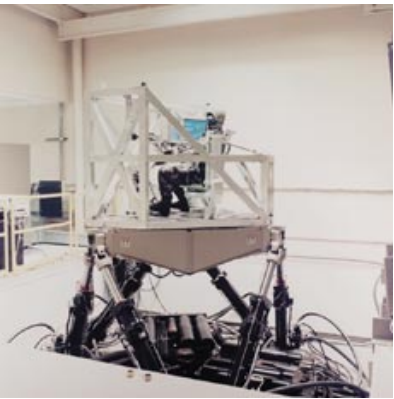
## Adding Motion

### The Ultimate Virtual Environment

Accurate system assessments, prior to system integration, require the ability to exercise linked subsystems in realistic environments with real soldiers at the controls. The unique motion base simulators of the Army and the Department of Transportation (DOT), linked together, provides such a capability. TARDEC, the University of Iowa and John Deere are collaborating to develop this realistic, engineering fidelity, virtual environment (VE) in the Vehicle and Heavy Equipment Virtual Proving Ground (VHEVPG) DUAP.

The VHEVPG program is generating common, high-fidelity models and visual databases that allow remote sites to monitor, view, and even control High Level Architecture (HLA) compliant distributed simulations. This environment facilitates the evaluation of vehicle and human performance, human-machine

interoperability, vehicle and crew compartment design, and the design of training simulators. The VHEVPG is using high-resolution vehicle models and terrain, high performance computing resources, along with three of the world’s most advanced ground vehicle motion simulators. These include both TARDEC’s Ride Motion Simulator and Crew Station Turret Motion Base Simulator and the DOT National Advance Driving Simulator located at the University of Iowa.



Engineers at TARDEC and commercial partners plan to exercise the capability of this distributed virtual environment by dividing a single vehicle amongst all three geographically distributed sites. As an example, the commander would be riding out-of-hatch in the NADS simulator, while the driver would be

driving in the RMS, and the remote turret exercised on the TMBS. These simulators can also be reconfigured to represent multiple vehicles operating in a shared battlefield.

Linking high fidelity motion simulators adds a new dimension to SimTLC. The user and subsystem hardware become an integral part of the development of vehicle systems, resulting in an efficient user oriented acquisition process. For further information contact Ms. Stacy Budzik at [budziks@tacom.army.mil](mailto:budziks@tacom.army.mil).

**Project Partners:**  
The University of Iowa, John Deere, and TARDEC



# Just in Time Information Web-based Collaboration Environment

## Project Partners:

Litton/TASC, Parametric Technology Corp. (PTC), and TARDEC

Key to the success of SimTLC and its process improvements is the capability to efficiently execute complex, yet flexible, processes involving participants, simulations and information, scattered all across the country. The Product Development Framework (PDF) Dual Use Application Program (DUAP), which partners Litton/TASC, Parametric Technology Corporation, and the Army, addresses this critical SimTLC requirement.

The PDF, developed in this DUAP, is an infrastructure that facilitates managed collaboration between distributed participants who access distributed information and simulation based tools throughout the entire product life cycle. The PDF is based on commercial information management

technology, specifically, PTC's Windchill. The PDF DUAP partners are extending this commercial technology and developing new services to provide web based information integration with closely coupled automated process workflow support tools.

TASC's information modeler, *Domain Engineer*, provides the capability to specify and analyze the relationships between design data, behavioral models, and requirements. It also provides a service to partition large complex data models into smaller loosely coupled subproblems.

Windchill is being extended by PTC to provide workflow management services which allows the definition, execution, and monitoring of workflow process maps. Particular attention is being placed on flexibility by requiring these workflow services to support in-process (ad hoc) task definition/modification.

TASC's *Director* tool acts as an intelligent front-end task generator to the workflow manager, providing change impact analysis services for the PDF. Director analyzes incoming design change proposals and identifies engineering data, models, simulations, requirements, and

engineering domains that may be affected. It is capable of automatically defining process maps used to facilitate the evaluation of proposed changes. Using Director, engineering change data and related tasks are automatically routed to the right people at the right time.

The PDF framework provides the technology to support a modern collaborative engineering process. Use of the PDF allows organizations to significantly reduce engineering costs and increase product quality by performing only necessary tasks with on demand information. For further information on the PDF DUAP, contact Mr. Ken Ciarelli at [ciarellk@tacom.army.mil](mailto:ciarellk@tacom.army.mil).



## Seeing is Believing Developing High Resolution Ground Terrain and Displays

Placing soldiers in operational virtual prototypes very early in the development process is an essential element to the success of SimTLC. In particular, soldiers in engineering fidelity motion simulators can provide critical feedback on the operational performance of developing vehicle systems. Realistic operator input can only be obtained if realistic environmental cues, particularly terrain features, are provided to the soldiers. The Advanced Ground-Vehicle Research Visual System (AGRVS) Dual Use Application Program (DUAP) addresses the development of high resolution ground terrain models and associated displays necessary for realistic user inputs in engineering fidelity simulators.

The tools being developed in AGRVS include: integrated harmony Image Generation equipment; Helmet Mounted Display capability for simulation of tank open hatch operations; visual displays to simulate gun sight target acquisition integrated into TARDEC motion based simulators; upgraded virtual terrain databases to better detail the simulated terrain environment; and a virtual terrain database modification tool to allow our engineers to modify terrain conditions to evaluate multiple vehicle design issues and alternatives. In addition, TARDEC will have the capability to network this advanced virtual reality terrain environment to other U.S. Army and DOD organizations in order to conduct design and operational evaluations with other systems, aircraft, etc.

The AGRVS is a key tool in the Army's efforts to make SMART decisions with soldiers. The AGRVS will give the soldier a chance to provide early feedback in the system development process and will provide for a more realistic soldier-training environment. For further information, contact Dr. Alexander Reid or Mr. Doug Miller at [{reida or millerd}@tacom.army.mil](mailto:{reida or millerd}@tacom.army.mil).

## Project Partners:

Evans & Sutherland and TARDEC

## The Automotive Research Center

Enabling software tools for the interaction and efficient manipulation of data and information are critical to the SimTLC process. This underlying infrastructure is the foundational layer of the entire process. Another important aspect of SimTLC is the use of high-fidelity modeling, simulation, and animation tools for representing the physical behavior of new and modified vehicle designs. The Automotive Research Center (ARC) at the University of Michigan is chartered to develop these capabilities.

ARC research is focused on the development of modular templates in five areas that fit together to create a hierarchical modeling system. The five thrust areas include: Intelligent Vehicle Dynamics and Control; Synthetic and Virtual Environments; High Performance Structures and Materials; Advanced and Hybrid Powertrains; and Integrated System Design and Simulation.

The foundational projects of the Intelligent Vehicle Dynamics and Control, High Performance Structures and Materials and Advanced and Hybrid Powertrains research groups are synergistically implemented to create real world, accurate predictions for vehicle mobility, safety, and fuel efficiency. The research of the Integrated System Design and Simulation group is used to optimize on the designs and to conduct trade-off and "what if" studies. Finally, the research of the Synthetic and Virtual Environments group is directed toward transitioning high-fidelity ARC models to immersive VR environments and to man-in-the-loop motion platforms (e.g. TARDEC's CAVE and Ride Motion Simulator). The research in these five topic areas is ideally suited to support the modeling and simulation efforts of the SimTLC program.

The ARC was established by the National Automotive Center at the University of Michigan in 1994. Today, the ARC comprises the University of Michigan, in partnership with Clemson University, Oakland University, University of Alaska at Fairbanks, University of Tennessee, University of Iowa, Wayne State University, and University of Wisconsin. For further information on the ARC, contact Dr. James L. Overholt at [overholj@tacom.army.mil](mailto:overholj@tacom.army.mil) or check out the ARC web site at <http://arc.engin.umich.edu/>.



# Soldiers on the Move

## Designing Wearable Display Devices

### Project Partners:

AB Technologies, Mindset Interactive, and TARDEC

## Laying The Foundation

(continued from page 1)

A SimTLC Collaborative Framework has been defined to integrate the many participants and enterprise resources involved in a system's life cycle. As shown, SimTLC's collaborative framework is represented as a series of concentric rings showing enterprise resources that are linked together with distinct interfaces.

The central circle of the SimTLC Framework represents the distributed enterprise information related to the system. It is the core of the many life cycle activities and is available to all enterprise resources through the Web based Data Integration ring. The enterprise's distributed tools ring are next. These simulation-based tools are used to implement the system processes and to manipulate the system data. Examples of these enterprise tools include: constructive and physics-based simulation models, visualization tools like the Cave Automatic Virtual Environment (CAVE), high-fidelity motion simulators like the Ride Motion Simulator, and training simulators like the Closed Combined Tactical

Trainers. The distributed tools are linked to each other by the Model Integration ring which uses glueware technologies such as DoD's High Level Architecture (HLA) and the commercial standard Common Object Request Broker Architecture (CORBA).

Using the network linked tools of the SimTLC Framework, new distributed processes are being defined to allow distributed functional expert's to collaborate concurrently. Philosophically, this diagram portrays a paradigm shift away from traditional product development and military acquisition methods, replacing slow, sequential activities with concurrent, timely activities.

To implement the SimTLC Collaborative Framework, TARDEC-NAC is leveraging it's investments into CAVE Automatic Virtual Environment (CAVE) technology, Power Wall displays, the Windchill Enterprise Information Manager, and related Dual Use Science and Technology (DUS&T) efforts. These state-of-the-art visualization and web based information integration methods are tailored to link together the various participants and resources involved in a system life cycle into an interactive, collaborative virtual enterprise.

The SimTLC collaborative framework stays consistent throughout the system life cycle, only the fidelity of the data changes as a system evolves. It relies on the timely distribution of accurate information that allows collaborative team members to collectively make more informed, SMART decisions.

Today's soldiers are soldiers on the move. SimTLC recognizes the importance of developing tools that support an individual soldier in today's information intensive environment. That is why engineers at AB Technologies, Mindset Interactive, strategic partners, and TARDEC-NAC are developing a wearable multimedia system, capable of providing a soldier with information at any place, at any time.

The goal of this development effort is to create a visualization system that is no more difficult to wear than putting on a pair of reading glasses, no more difficult to operate than naturally speaking, and no more burdensome than slipping on a belt —giving our soldiers the flexibility to maneuver in a hands-free mode within the environment while accessing vital information.

Some of the features include:

- a head-worn personal visual and audio interactive display, capable of projecting 2D monoscopic or 3-D stereoscopic images directly in front of the User's eyes
- portable, low power 800x600 pixel resolution Liquid Crystal Display (LCD)
- a wearable multimedia backpack personal computer with appropriate input devices, capable of wireless local area network connectivity via PCM/CIA card-based RF Ethernet
- a laptop server and docking station for the backpack personal computer
- voice recognition and control
- mobile networking capability
- information management software that enables a number of maintenance, training, or on-vehicle uses of the devices

The mobile system has many applications to the Army including logistics and maintenance support data, soldier training, command and control, information on the move capability, and global information sharing. This type of system can be applied across a wide range of vehicle platforms, from main battle tanks to HMMWVs, impacting the way soldiers make decisions both on the battlefield and in support functions by enhancing the way they receive, process, and act on critical information. In addition to the military benefit, PVE technology has a wide range of commercial application areas, including manufacturing, maintenance support, training, distributed learning, and entertainment. For further information, contact Dr. Grace M. Bochenek at [bocheneg@tacom.army.mil](mailto:bocheneg@tacom.army.mil).



# Investing in SimTLC Collaboration Technologies

## Advanced Visualization and Immersive Virtual Environments

Virtual Environment (VE) systems, sometimes referred to as virtual reality, have the potential to significantly impact the system acquisition process. By their nature, these systems are capable of stimulating the human senses of sight, sound, and touch. They allow a person to experience life-like domains and objects that appear to be real but only exist in a computer-based environment. In the eyes of a soldier, immersion in such a near-realistic environment can provide visualization of the final system from various perspectives. For instance, a soldier could sit in the cockpit of a future vehicle system and begin to figure out how to fight with new enhanced capabilities, providing early insight into the user requirement definition process. Using VE systems, integrated concept and integrated product

teams could visualize a final system, assemblies, sub-assemblies, or components, all in 3D.

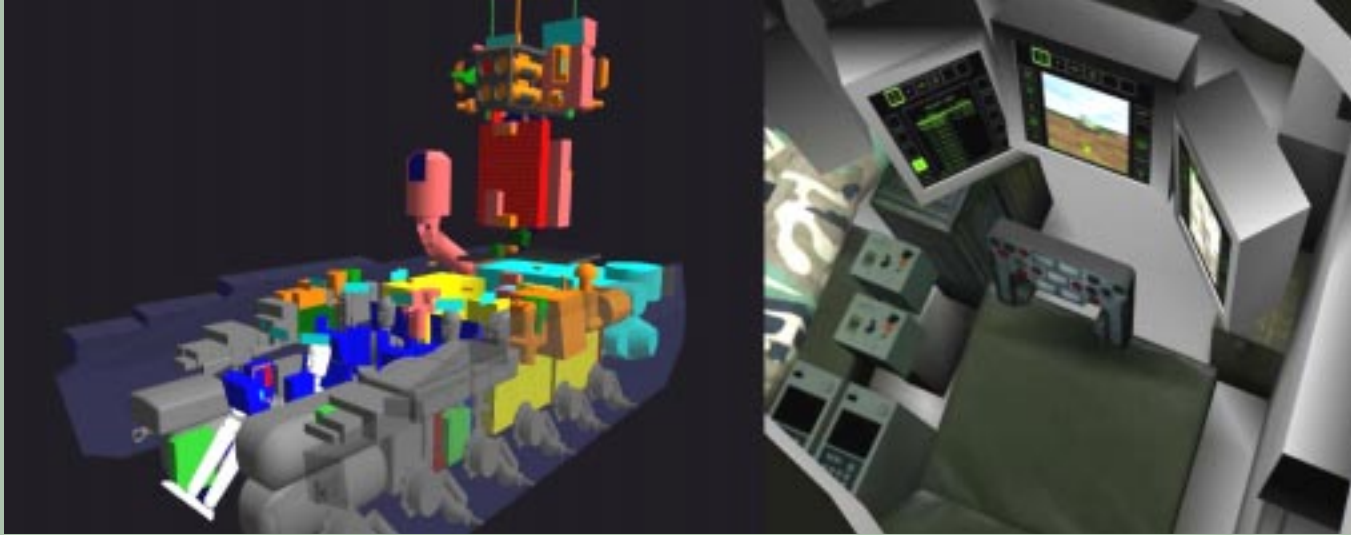
The NAC has invested in several advanced visualization and virtual environment tools that support collaborative activity. These are a CAVE Automatic Virtual Environment (CAVE), a Powerwall, and a 180° screen front-projection viewing device. The CAVE, a 10x10x10-foot structure that consists of rear-projected screen walls and a front-projected floor, is a multi-person, high resolution, 3-D graphics video and audio environment. Using special “stereoscopic” glasses inside a CAVE, the user is fully immersed. Images appear to float in space, with the user free to “walk” around them, yet maintain a proper perspective. Using similar technologies the Powerwall

and 180° screen are able to project life-size three-dimensional images.

These visualization technologies, to one degree or another, offer the potential for true team interaction. Integrated concept or process teams could simultaneously enter a virtual product design world and jointly evaluate design issues, ideas, and parameters — each from their own experience, perspective, viewpoint, and functional responsibility. As a result, members from various functional elements would thus become more knowledgeable about other activities and therefore, would become a more integral part of the total decision making process.

In addition to participation and collaboration, the use of VE for product design provides design flexibility by allowing the exploration of various options and

the opportunity to generate and iterate “what if” exercises early in the design process where mistakes are less expensive to correct. If so, significant cost savings could be achieved in system design and development because many of the problems would be identified and corrected prior to the actual physical product construction. VE technology will enable developers to refine designs before commitments are made, by bringing users into the design process much earlier and allowing the Army community to solve problems in a more collaborative group setting. For further information on TARDEC’s visualization and virtual environment technologies, contact Dr. Grace M. Bochenek at [bocheneg@tacom.army.mil](mailto:bocheneg@tacom.army.mil).



### Getting input from real soldiers

Bringing real soldiers into the acquisition process, especially new acquisitions, is one of the most important goals for SimTLC. To support this effort, the NAC has integrated a CAVE into the Mounted Maneuver Battle Lab (MMBL) at Ft. Knox, Kentucky as a test site for SimTLC experimentation. Together, engineers and soldiers will test developed collaboration tools and help integrate new processes so Users and Engineers can conduct simultaneous evaluations of new vehicle concepts in a virtual environment. The main objective is to create a shared experience and environment that will lead to more informed, intelligent decisions. SimTLC will address early assessment of technologies to support the Army’s Combined Arms fighting methodology. In addition, planned experimentation at the MMBL CAVE site will help the Army community investigate how engineering level models and simulators can be transitioned and how data can be reused for insertion into Army training systems such as the Closed Combat Tactical Trainer. SMART decisions will also be enabled by developing these collaborative tools and processes that “morph” the material and combat developer more closely into one.

### An Affordable Assessment Model for DOD

Distributive Knowledge Environment (DKE) Program is under development by DUSD(L). This program will provide the infrastructure and the process to support improved decision making across the DoD. DKE’s focus includes developing a Smart Enterprise Model (SEM)



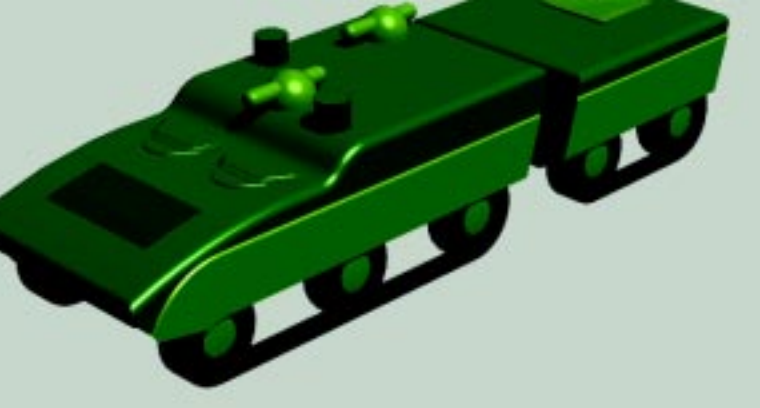
## Government Partners

that allows Program Managers (PMs) to postulate changes to a configuration or operation, simulate the result of implementing these changes, and select alternatives that provide the desired performance within given resource constraints. DKE provides facilities to populate the SEM using existing legacy resources. Model sets and databases

supporting specific domains will be available to engineers and PMs to bring current information into the SEM. The DKE program will use the FMTV Cab redesign program as one of its “pilot” applications to evaluate the DKE process and to develop advanced techniques to better use the DKE SEM. Using DKE, the PM can change a component design in the solid model and readily see the impact the change has on the cost, schedule, and performance of the vehicle. A proposed engineering change in the FMTV may impact the Performance Affordability Assessment Model, performance specs of the design, and some structural analysis of the design. Without leaving the office, the PMO and his/her engineering staff will be better able to see how the proposed engineering change impacts all areas of the product including performance requirements and cost. It will not only speed up the decision making process but will also save resources.

### Linking the Army’s Expertise — Army Research and Development Centers’ moving the force into the 21<sup>st</sup> century

The SimTLC environment will promote collaboration between the Army’s technical experts, linking distributed functional expertise and distributed technical data in an effort designed to build military systems faster, cheaper, and with higher quality. The goal is to ensure that technological advances will be fully integrated into all research and development programs, thus giving our forces strategic advantages will into the 21<sup>st</sup> century.



# SimTLC Pilot Projects On Target with Real Solutions

*To accelerate the development of new Army processes for system development and support, SimTLC is applying its collaborative technologies and SMART principles to real Army programs in three pilot projects. These pilot projects cover the full spectrum of a vehicle's acquisition life cycle, from concept exploration through fielded system support. The SimTLC pilot programs include the Advanced Concepts Pilot(Pre MS0 - MSI), Grizzly (MSII) and FMTV (Post MSIII), each involving the associated Program Manager and Army RDE Centers.*

## Lock on to soldier requirements through SMART simulation and modleing.

Activities in the early stages of vehicle development, Pre-milestone 0 through Milestone 1, are Requirements Definition, Technology Development, and Trade Studies. Typically, this is a long, iterative process between the User and the Material Developer. These Concept Exploration Studies are used to refine User requirements and assess technologies through system integration tradeoff studies. Many Army organizations across the country are involved, each needing to share this rapidly changing information. To make this critical Army process more effective and efficient, these organizations are merging SimTLC collaboration technologies with their modeling and simulation tools in the SimTLC Advanced Concepts Pilot.

The effort is broken down into three logical steps. The first phase will be for the User, Materiel Development, and Industrial Communities to collaborate on the development of the Refined Advanced Concept Exploration Process (Pre-MS0). This process will be defined using Integrated Product and Process Development (IPPD) principles and techniques. Phase 1 will yield the inter-relationships between process elements/work flow, organizations, data sources, M&S inputs/ outputs, and vehicle work breakdown that are required to tailor SimTLC tools to the Army's needs for project management and collaborative

engineering development. Phase 2 will apply the new IPPD template and the tailored Collaborative Environment to the Initial Engineering Assessment of the Future Combat Vehicle Program. Phase 3 will develop the IPPD process and infrastructure for Milestone 0 to I. For more information, contact Mr. John Lewis at [lewisj@tacom.army.mil](mailto:lewisj@tacom.army.mil).

## Bigger Bang for the Buck in Pre-Production Evaluations

To help pre-production system PMs identify potential problems, minimize risks, and reduce operational testing, SimTLC offers integrated simulation and collaboration tools addressing this particular phase of the system life cycle. TACOM, PM-CMS, PMO Grizzly and the Mil Dep. for SARDA have agreed to resolve PMO issues for the Grizzly program. This SimTLC pilot project is focusing on proving out production capabilities through virtual manufacturing assessment, development of models to evaluate vehicle performance, and improvement of related Army synthetic databases. By solving real problems, this effort will provide insight into new acquisition methods that will assist PMO offices across DOD. Most importantly, the SimTLC process, tools and technology will facilitate the PMO's ability to weigh alternatives, evaluate performance, reduce IOT&E cost, and minimize component technology testing. For more information contact Mr. Robert Culling at [cullingr@tacom.army.mil](mailto:cullingr@tacom.army.mil).



## Firing Back Solutions to Challenges from the Field

Maintaining readiness, technology superiority, and operational utility on a changing battlefield are everyday challenges faced by fielded systems and their PMs. SimTLC offers a cost-effective approach for finding real solutions for these real challenges. The FMTV is one fielded Army system that is using SimTLC and DOD developed Distributed Knowledge Environment (DKE) to solve real vehicle design challenges. TACOM, PEO-CGSS, PMO FMTV and the Mil Dep. for SARDA have agreed to use the SimTLC Process and DKE technology to support FMTV. The FMTV Program is past Milestone III and has finished fielding the first two Divisions with delivery of over 10,000 vehicles. The PM office and soldiers in the field identified FMTV design challenges to be solved in SimTLC's collaborative, simulation-based environment. This SimTLC pilot project will evaluate alternative cab designs in a synthetic virtual environment. It focuses on evaluating alternative engineering solutions, cost, performance, and logistical impacts for alternative hardware configurations. Resulting data will be useful for future procurement actions and for addressing the real issues facing PMO offices across DOD in their efforts to field better systems and improve the acquisition process. For more information, contact Mr. Ram Desai at [desair@tacom.army.mil](mailto:desair@tacom.army.mil).



### SimTLC On the Web

For more information on the SimTLC Program, its partners, and all affiliated activities, please visit our web site at [www.simtlc.org](http://www.simtlc.org).

**The Innovator** is a technical outreach document distributed by the National Automotive Center (NAC), the Nation's unique laboratory for the development and execution of collaborative research. By fostering relationships and forming cost-shared partnerships, the NAC accelerates the exchange and implementation of automotive technologies.

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